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How did the advancement in weapons technology prior to World War One influence the rapid evolution of German infantry tactics from 1914 to 1918?

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ABSTRACT *(MAXIMUM 200 WORDS)*
Between 1870 and the start of World War I the technical development of weapons (machine guns, infantry rifles, and artillery) advanced tremendously. During the same period, the German army studied new tactics and the effects of using these modern weapons. Due to the relatively slow advance of tactics development there was a disparity between modern weapons capabilities and infantry tactics by the start of the war. Necessity being the mother of invention, the Germans acted aggressively in finding a way to defeat the advanced firepower that had emerged. Through experimentation and training, and the existing German ability to adapt at every level, they developed the famous "Storm Troops" that momentarily broke the deadlock near the end of the war. After World War One these new tactics were taken up by other forces around the world and eventually led to German Blitzkrieg tactics and the basis of our own infantry tactics.

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Preface

Bullets quickly write new tactics.

-Wilhelm Balck

The fact that there has been significant evolution in infantry tactics during the past century is taken for granted. Also, it is well documented that the predominant advancements in tactics took place between 1914 and 1918, during World War One, rooted within the German army. However, the cause and effect that initiated this rapid evolution is somewhat unclear. Was this advancement solely due to the inspiration of one or more German commanders of the time? Was this advancement in tactics a Revolution in Military Affairs? Or, was this merely an evolution in tactics resulting from advancements in fire power due to technology improvements in infantry weapons such as the machine gun, infantry rifle, field artillery, etc.

Prior to World War I the German army had studied and toyed with new tactics off and on. By 1914 they were still practicing traditional tactics against the Allies. The use of these tactics against the massive destructive capability of modern weapons available to both sides at the start of the war caused enormous numbers of casualties. The German army, in comparison to the Allies, was limited in numbers of soldiers and material and could not afford to continue to keep up with the high attrition rate. Necessity being the mother of invention, the Germans acted aggressively in finding a way to defeat the advanced firepower that emerged during the war. Through experimentation and training they developed the famous “Storm Troops” that momentarily broke the deadlock near the end of the war. After World War I these new tactics were taken up by other forces around the world and eventually led to German Blitzkrieg tactics of World War Two.

How did the advancement in weapons technology prior to World War One influence the rapid evolution of German infantry tactics and command and control from 1914 to 1918?

Introduction

The basics of modern infantry tactics were born on the battlefields of World War I. The seeds of this birth were laid prior to the "Great War" and then cultivated and hatched by the German army during the war. These offensive tactical developments culminated in what is agreed upon to be a Revolution in Military Affairs (RMA) in infantry tactics at the end of the war in 1918. This paper will demonstrate that this RMA is directly linked to the evolution of modern weapons that were used at the start of World War I, which was in itself a series of Military Technical Revolutions (MTR). These highly successful German infantry tactics evolved directly from a natural reaction to the devastating effects of modern weapons. In addition, the German army's ability to recognize the problem, initiate and experiment with new tactics, and then train and organize the army while in the middle of "The Great War" allowed them to fully develop these tactics placing them at a great advantage over the Allies.

Credit for the revolutionary offensive tactics of "Stormtroops" is often given to one or more German commanders who were thought to have invented them, such as Oskar von Hutier or Eric Ludendorff.[1] It has also been postulated that these tactics originated from the Germans capture of the French pamphlet on improved tactics that the French themselves failed to adopt. Despite these theories, the development of Germany's infantry tactics in the offense was the product of the initiative and foresight of not one, but a multitude of German officers. The initiative demonstrated by these individuals, coupled with the German army's ability to adapt, some initial

experimentation before the war, and Germany's necessity to overcome technology with tactics, provided the army of 1918 with offensive infantry tactics that were instrumental in the successes of the last German offensives. These tactics also laid the groundwork for the Blitzkrieg tactics of World War II and the basic infantry tactics we use today.

For background purposes, infantry tactics and weaponry used prior to the war will first be discussed to form a relative base line. In the *Study and Experimentation* section I will describe how the German army studied the lessons learned from earlier conflicts and how they affected tactics development and changes in doctrine for infantry attacks. The situation during the opening stages of the war will then be looked at to show how it led to the Germans changes in tactics. These developments in tactics throughout the war will be shown chronologically, ending with an overview of the tactics that the Germans used during the 1918 spring offensive. This section will address German as well as Allied offensive tactics, organization structure, and command and control. The object throughout will be to show a sequence of causes-and-effects that will lead from modern weapons developments to the German infantry tactics used in the 1918 offensive.

The scope of the discussion on these tactical and technological advances is limited to land warfare, frontline weapons, and offensive tactics, based on the World War I and the German infantry, roughly from 1914 to 1918. The period before World War One, from the American Civil War onward, will be used to discuss previous developments only. Focus will be primarily on the German army but the British, French, Japanese, Russian, and American military will be used as comparisons. The weapons discussed will primarily be the machinegun, field artillery,

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[1] Stormtroop is the name commonly given to the squad sized surprise assault units called Sturmtruppen (Storm units)

and the infantry rifle. Tactics will be focused at the small unit level from squad to regiment size units. The level of warfare discussed will be restricted to the tactical level, the operational and strategic outcome of the war is all too well known.

There are a few generalizations that must be addressed for this paper. First, the German army will be referred to as a whole, despite distinct individual sections of the army that may have operated differently from one another. This is important in that part of the proof of establishing a new generation of infantry tactics is that they apply to the whole army and not independent or specialized units. The second is the reference to modern weapons, which will include the generation of rifles, machineguns, and artillery that were in use by the start of World War I. The last generalization is the reference to new or modern tactics. These tactics include open order and independent infantry formations with the use of coordinated and combined arms that operate using decentralized control.

Background

To provide a baseline of weapons and tactics development at the start of World War I, this background will cover two items. The first will be a summary of the developments in modern weaponry leading up to the start of World War I. The second will be an overview of several examples of wars leading up to World War I that had a direct influence on tactics development and the use of modern weapons. Included in these examples will be lessons learned that the German army took away as observers or participants in these conflicts.

Modern Weapons Technology Development

The hundred years between the battles of Waterloo and Mons saw startling developments in the technology of firearms and an exponential increase in there effectiveness in regards to rate of fire, range, and accuracy.[2] These improvements were made possible primarily because of the industrial revolution, which brought better manufacturing techniques, improved materials, and quality mass production. Although this weapons technology advance was relatively slow to develop it culminated just after the turn of the century with an assortment of capabilities that were not fully realized until the start World War I. For the scope of this paper we will look at the three weapons that had the greatest impact on tactics development in World War I, the infantry rifle, the machinegun, and field artillery.

Infantry Rifle

The prevalent rifles during the Civil War period were muzzle loading, black powder, Minie muskets. These were typically fired from a standing position at two to three rounds per minute

[2] Martin Samual, *Doctrine and Dogma: German and British Infantry Tactics in the First World War* (New York, Greenwood Press, 1992), 9

with an effective range of 100 yards.[3] Compare this to the 600-meter range, 10-15 rounds per minute, flat trajectory, breech loading, and smokeless powder of updated rifles by 1914.[4] The technological advances that produced these capabilities included rifled barrels, high capacity magazines, fixed ammunition, elongated bullets, and clean burning, high power, nitrogen based propellants. These advances resulted in the ability for a single infantryman from a covered position to be able to engage the enemy out to as far as he could see. The increase of rate of fire, accuracy, and range of these weapons increased the overall firepower and effectiveness of infantry exponentially, allowing them to engage targets at greater ranges while under protective cover. The sheer increase in volume of fire made a single rifleman equivalent to a squad in regards to the number of rounds he could put down range in a given amount of time. The increased range directly affected how could an attacker cold approach the enemy before coming under fire.

The Machinegun

The first real machinegun, as we know it today, was invented by Hyram Maxim in the 1890s. The Maxim, shown in figure A1, was widely produced and copied around the world and became the basis for most machinegun designs used by England, France, Russia, Germany, United States and others.[5] The first machineguns were not very mobile and were often placed with the artillery batteries for defense because of lack of mobility and concerns of supplying them with the large amount of ammunition that they could go through.[6] Machineguns were modified during the war to be more mobile and to use the same ammo as the infantry rifles. Most of these weapons fired

[3] Samual, *Doctrine and Dogma*, 9
[4] Ibid, 10
[5] Jack Weller, *Weapons and Tactics: Hastings to Berlin* (St. Martine Press, New York, 1966), 81
[6] Weller, *Weapons and Tactics, 81*

approximately 500 rounds/minute, of about 0.30 caliber, with effective ranges out to 2,000 meters, and were usually water-cooled. Additional details on machineguns and other weapons are included in Appendix A. The effect of these new weapons was devastating to the uninitiated and resulted in enormous numbers of casualties. The range and volume of fire created by machineguns in the defense increased the killing ground that an attacker needed to cover before reaching the defending enemy. Although initially used as a primary defensive weapons, light machineguns were developed during the war to be used in offensive assaults. "The (increased) dominance of the light machinegun" during later stages of the war, also " caused a gradual reorganization of infantry units" to use their firepower as an organic weapons when attacking. [7]

Artillery

Improvements in the field gun between the American Civil War and World War I totally changed they manner in which they were used. Most casualties inflicted by artillery before World War I was from canister rounds at relatively close range and not from long-range indirect fire. In general, massed infantry rifle barrages caused most of the casualties during the Civil War.

Improvements in artillery, post Civil War, included high explosive (shrapnel) shells, smokeless propellants, recoil mechanisms, steel lined rifled barrels, better sighting equipment, breech loading, and small arm shields to protect the crew. Shrapnel rounds produced a greater killing effect on infantry. Breech loading, recoil mechanisms, and bag propellant increased the rate of fire for artillery ten fold. Likewise, increases in accuracy caused artillery to quickly

[7] Timothy T. Lupfer, *The Dynamics of Doctrine: The changes in German Tactical Doctrine During the First World War* (Combat Studies Institute, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas), 27

abandon the role of direct fire and extended their range using indirect methods.[8] The combined effect of these improvements can be seen in the percentage of casualties from artillery shown on table A1. The increase in range of artillery, by a factor of 4, in turn increased the danger zone out to 5000 meters.

This increase in artillery effectiveness caused some theorists to determine that artillery was capable of clearing enemy positions by firepower alone. This prompted commanders to place more emphasis on artillery support, to such an extent that it was perceived as the decisive arm in battle. As artillery played an ever-increasing role on the battlefield debates arose concerning integration with infantry, centralization of battery placements, and ensuing communications problems because of the longer distances involved.

The combined effects of these three weapons improvements created a larger and more lethal battlefield due to increases in range and lethality. The killing ground produced in front of the defender, almost impenetrable by attackers, grew from 300 meters to over 2500 meters.[9] Parallel efforts in different countries, or transfers of technology between them, resulted in most of the armies of World War I being similarly equipped. Each of these new weapons decreased the ability of normal infantry to attack well-defended positions and resulted in massive casualties during the initial stages of World War I. This drastically reduced the effectiveness of all massed infantry and cavalry formations in the open during daylight and resulted in "…one protected mans capability of defending against several attackers…which raised the odds for the defense."[10]

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[8] Samual, *Doctrine and Dogma*, *10*
[9] Antulio J. Echevarria II, *After Clausewitz: German Military Thinkers Before the Great War* (Lawrence, Kansas, University Press of Kansas), 70
[10] Weller, *Weapons and Tactics*, 80

Early Examples of Tactics Development

There were several conflicts between the American Civil War and World War I that were instrumental in the development in infantry tactics and demonstrated the use of and counter to modern weapons. These examples were used by the German army, as well as the Allies, to study and develop new tactics. In most cases the German army sent observers or provided advisors during the conflicts, providing them with first hand knowledge of the tactics being used and their effectiveness. The observations and lessons learned were brought back to Germany and studied, debated, and provided guidance for reforms in German tactics. It is important to note, however, that Germany did not participate themselves in any large-scale conflicts between the mid 1870s and 1914 in which they could have practiced early tactics reforms.

Franco-Prussian War (1870-1871)

The war between Prussia and France in 1870 resulted in several lessons learned that were a foreshadowing to tactics reforms in the future. This conflict saw the initial uses of longer range infantry rifles and artillery which began to influence how the Germans looked at conducting the attack. At first an ad-hoc development took place to offset the deadliness of the French chasspot rifles and mitrailleuse machineguns. Artillery began to support skirmish rushes at pre-designated locations in the enemy line to concentrate firepower. The assault force would then sprint the last 100-300 meters to finish with bayonets. Difficulties encountered were control of the loose formations, the short range of the artillery, communications, and inadequate leadership.[11] It became apparent that a "better system of control to prevent a dilution of effort" was needed. Over the course of the war the Germans "…increased independent action and dispersion among

[11] Echevarria II, *After Clausewitz*, 36

troops, enhanced unity of action and degree of synchronization between fire and movement."[12] The first inklings of using standardized tactics and mission type orders that would allow a free-form approach to directing troops on the battlefield were part of the lessons learned. The dilemma that became apparent during this war was "how best to control fire and movement of thousands of troops through various stages of a large scale attack."[13] This conflict directly impacted some of Germany's more influential military thinkers such as Molke the elder, Captain Albrecht von Boguslawski, Wilhelm von Scherff, and Colonel Sigismund von Schlichting. Molke noted at this time "improvements in infantry weapons necessitated a complete change in the tactics of all arms."

The Matabele and Dervish Wars

The first use of the machinegun by the British in a major battle was by colonial forces in the Matabele War (1893). The British overcame great odds by using four Maxim machine guns to fight off 5,000 Matabele warriors in a single engagement.[14] Another example with the British during the same period was the use of Maxims in the battle of Omdurman-Sudan (1898) against the Dervishes. This conflict resulted in 26,000 Dervish casualties in a single battle, mostly due to machinegun fire against close-order formations.[15] These conflicts clearly demonstrated the lethal effects of modern weapons on close order formations. The British became fond of saying, "We have the Maxim and they have not."

[12] Ibid, 32
[13] Ibid, 33
[14] Ibid, 13
[15] John Montgomery, *Toll for the brave: the tragedy of Major-General Sir Hector Macdonald, (M. Parrish,* London, 1963),

Boer War

During the Boer War of 1900, the British initially used close order formations and were defeated by an inferior number of Boers that used what was then called "irregular" tactics. The Boers tactics involved dispersed formations, good use of terrain for cover, and attacks at night, all of which rendered the use of British machine guns and artillery ineffective.[16] At Bidulphsberg, for example, "a mere 18 Boers, using ground and shooting straight, defeated two battalions of Guards in their long unarticulated lines."[17]

Towards the end of this conflict the British began implementing similar "irregular tactics". At Colenso, in December 1899, Major General Hildyard, after first attacking in conventional, tight order, formed up his brigade in half-companies with 6-8 yards between each man and 50 yards between units.[18] This extremely open order successfully advanced with minimal losses against the well-prepared defenses of the Boers.[19] The British also learned to integrate their machineguns with the infantry to great effect. These lessons demonstrated the effectiveness of the new rifles, the use of machineguns in defense, and the value of open order formations in the attack. "By 1900, the British had begun to learn firsthand the importance of … large scale coordination of fire and movement."[20] This encounter was a good indicator of things to come from both the offensive use of dispersed formations and the defensive use of integrated fires. The Boer Wars became the new baseline for armies across the globe to study from, and compare to.

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[16] Weller, *Weapons and Tactics*, 82
[17] John Alan English, *On Infantry*, (New York, Praeger Publishers, 1981), 5
[18] English, *On Infantry, 6*
[19] Ibid, 6
[20] Echevarria II, *After Clausewitz*, 74

Russo-Japanese War.

The Russo-Japanese War (1904) also foreshadowed tactics development in World War I and demonstrated the cost in casualties when attackers remained visible within range of the enemy.[21] The use of fortified defensive positions and heavy machineguns (water cooled Maxims) by the Russians during the siege of Port Arthur resulted in 12,000 Japanese killed and wounded in a single battle compared to only 3,000 Russians.[22] Once again, this clearly demonstrated that unsupported infantry attacks would result in massive casualties and also completely negate mounted cavalry.[23] The Germans, newly appointed as advisors to them, observed that the Japanese, after starting with close order column tactics, changed to more open formations after suffering heavy casualties. This coincided with greater freedom for platoons and squads to maneuver independently.[24] Rushes made by companies were usually executed in wide extension since constant motion was regarded as the best protection against the fire of artillery.[25] This was also the first use of the telephone to communicate coordinate infantry and artillery.

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[21] Weller, *Weapons and Tactics*, 85
[22] Ibid, 85
[23] Ibid, 85
[24] Bruce Gudmundsson, *Storm Troop Tactics: Innovation in the German Army, 1914-1918*, (Westport, CT, Praeger, 1989), 21
[25] English, *On Infantry*, 7

Study and Experimentation

The Boer and Russo-Japanese wars were clearly precursors to World War I in both tactics development and in the use of advanced weapons. Each of these encounters was a distinct indication that offensive infantry tactics needed to adapt to overcome the effects of modern weapons. The Germans, as well as the other military powers, studied these conflicts in depth, discussed and then wrote about them extensively leading up to World War I. British Lieutenant Colonel James, U.S. Major James Chester, France's Ferdinand Foch, and Russia's Zainchkovskii and Puzyrevskii each wrote widely accepted works on infantry tactics during this time frame that recognized the problem of modern weapons and provided solutions. The German army went so far as to include changes in the 1888, and later versions of, Infantry Regulations concerning dispersed order formations, coordinated firepower, use of terrain and commanders intent.

Early German Tactics Development

German tactical doctrine began to evolve rapidly between 1870 and 1914. During the 1880s and 1890s Sigismund von Schlichting suggested using a combination of defensive and offensive tactics by incorporating the defenders advantage of systematic planning, use of cover, and carefully directed firepower into the offense.[26] Some of his ideas were adopted as official infantry regulations in 1888.[27] Artillery's close cooperation with infantry started as early as 1870, with priority in supporting infantry instead of counter battery fire. Baron Colmar von der Goltz, head of the Army Corps of Engineers at the turn of the century, was one of the first to realize that the next European war would be a bloody mechanized slugfest. The elder Moltke, General Staff Quartermaster Friedrich, and War Minister Heinrich von Glossler were of the same

[26] Echevarria II, *After Clausewitz*, 124

opinion that Germany needed more offensive firepower and ingenuity in the field.[28] Schlichting's *Tactical and Strategic Principles of the Present*, 1897 to 1899, addressed the experiences of the Boer War calling for "…delegated tactical decision making, open-order formations, and assaults that developed gradually and made full use of foxholes and cover".[29]

The Germans studied the Boer war intently and drew valuable tactical lessons from Britons experiences. The "…repeated humiliation of the British regular army by a frontier militia…" led to many German military articles warning of the obsolescence of close order tactics.[30] From these Boer War lessons learned Helmuth von Moltke, the younger, initiated an experiment in 1902 to test new attacking techniques paying close attention to the ravaging effects of modern weaponry".[31] With this in mind, Goltz took the *Pionieres* from the Corps of Engineers to form an independent branch of assault sappers.[32] The exercise proved to be a success and prompted William II to order "every corps familiarize its officers and men with the new tactics" and continued trials using "Boer tactics".[33] Even if these so called "Boer tactics" were actually a rekindling of Schlichting's ideas from as early as the 1870s "many young officers saw the new technique as a means to certain victory in the age of magazine rifles and machineguns."[34]

A continual threat of war at the turn of the century forced the German army to handle technological developments in a continual catch-up mode where they would hold updating weapons for fear of starting a war while they were in mid production. The Russo-Japanese War

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[27] Ibid, 133
[28] Echevarria II, *After Clausewitz,*
[29] Ibid
[30] Ibid
[31] Brose, *The Kaiser's Army*, 88
[32] Eric Dorn Brose, *The Kaiser's Army, The Politics of Military Technology in Germany during the Machine Age, 1870-1918,* (New York, Oxford University Press, 2001), 105. Pioniere units were similar to combat engineering units of today and were used for breaching obstacles, building fortifications, working with explosives, etc, but not for aggressive assaults.
[33] Ibid, 88

re-established the need for machineguns and prompted new developments and testing in 1907, resulting in recommendations for integrating six-gun batteries into every infantry regiment.[35] By 1910 machinegun detachments were being placed with the infantry during yearly Imperial maneuvers and the numbers of guns per regiment slowly increased when funding became available. In 1911 Imperial maneuvers started to include machineguns in the attack as well as mobile field artillery, instead of just being used in the defense, demonstrating a sense of task organization and combined arms.[36]

Despite the doctrine updates to the German Army *Drill Regulations of 1888*, and some initial experimentation, there was still resistance among senior German officers concerning open order tactics for fear of having the formations fall apart. As was common during this time period, large numbers of troops often took advantage of being far enough away from officers to permit them to hide during battle, or surrender in mass.[37] "The increased casualties that resulted from dense formations were considered to be a fair price to pay for the guarantee that troops would remain and fight."[38] Commanding officers were reluctant to change tactics due to mistrust of the moral spirit of their own men who traditionally required heavy discipline to press home the attack.[39] Officers often became preoccupied with keeping troops moving together instead of thinking about how to defeat the enemy. In addition, training of the independent armies across Germany was not standardized. Each unit commander was free to train how he saw fit. All of these factors contributed in preventing the Germans from putting the lessons learned and experimentation before the start of World War I to use on the field.

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[34] Ibid, 90
[35] Brose, *The Kaiser's Army*, 142
[36] Ibid, 145
[37] Gudmundsson, *Storm Troop Tactics*, 8
[38] Ibid, 8

The army was not standardized but, allowed army, corps, and division commanders to implement their own tactical preferences and experiment on their own, making tactics personality dependent. The German army at the time consisted of 23 army corps, spread over several different armies that were separated by geographic regions, which led to a wide variety in training methods, where some units were practicing these new tactics while others were not. Without standardization these reforms in tactics were not consistent and changed from exercise to exercise. Despite the initial successes of Boer Tactics, even with the addition of machineguns, the Germans gradually reverted to a priority of horse cavalry and close order, closely controlled infantry tactics during the early 1900s. In practice it was determined too difficult for a platoon commander to control 80 men over a 300 meter front, or a battalion commander over 3000 meters. German training soon reverted back to close order tactics. Despite the reluctance of German Doctrine to change as a whole, portions of the German army continued to study and experiment with new tactics on their own. This may have lead to the Germans Guard Corps practicing "Boer tactics" as early as 1902.[40]

Despite the reluctance of most commanders to use the new tactics, there were minor items written in the German *Drill Regulations of 1906* that indicated that as a last resort smaller units might have to maneuver independently to gain distance before the bayonet charge. Also, the Russo-Japanese War (1904) tended to end many of the debates on the use of dispersed formations and decentralized control helped to prove Schlichting's earlier ideas.

By 1906 Bulow and Major General Fasbender became instrumental in directing a commission to review Germany's infantry tactics. Subsequently Bulow, Emil Eihhorn, and Max

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[39] Samual, *Doctrine and Dogma*, 12
[40] Gudmundsson, *Storm Troop Tactics*, 20

von Boch und Polach revised the *Infantry Regulations of 1906* to include the concepts of training leaders and infantrymen to think and act under their own initiative, and to promote the innovation of subordinates without complete independence.[41] This revision also stressed the importance of firepower superiority, dispersion, use of terrain and cover, speed/tempo of the decision cycle, and the coordination and synchronization that is essential between artillery and infantry.[42] Corps commanders slowly transitioned to practicing the new regulations over the next few years and by 1908 they were executing them during the annual Imperial exercises again. In the *1908 Field Service Regulations* it was emphasized that Officers were "…advised to cultivate the initiative, self-reliance, and sense of honor of the individual soldier".[43] The acceptance of these new tactics by corps commanders slowly happened over the next few years.

Despite controversy among leaders and non-standardization among army corps, the major concepts developed during this time period reflect incredible insight in modern tactics development. For instance, Boguslawski insisted that every soldier should be trained as a skirmisher, to utilize terrain and operate independently or in small groups, unobserved by officers.[44] The army began to see the need to raise the level of training to make all soldiers self sufficient, think and decide on their own, exercise initiative, and to stick with the fight while out of sight or earshot of superiors. Boguslawski summarized these ideas in *Tactical Deductions from the War of 1870-71*. Scherff introduced the concept that increased rates of fire "raised the ratio of activity to time". Or described differently, a higher lethality increased the tempo of the decision cycle, making decisive points happen faster and requiring subordinate leaders to make

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[41] Echevarria II, *After Clausewitz*, 124
[42] *Ibid*, 125
[43] Gudmundsson, *Storm Troop Tactics*, 22
[44] *Echevarria II, After Clausewitz*, 36

quick decisions on fleeting opportunities.[45] Along these same lines, Captain Wilhelm von Plonnies wrote "… weapons brought about local decisions in a matter of minutes, even seconds" equating to shorter reaction/decisive action times, and increased the shock effect that demoralized troops.

Scherff also articulated three danger zones of the battle field measured from the front of the enemies lines; out to 800 meters was covered by aimed rifle fire, 800-1800 meters was un-aimed infantry fire and machinegun range, and from 1800-5000 maters was aimed artillery.[46] He also advocated the need for fire superiority at the decisive point in the attack, and not necessarily for destruction of the enemy. Scherff compiled these new concepts in *Studies in the New Tactics of Infantry*.[47] Schlichting's ideas included independent action of subordinates, dispersed order, use of terrain, and commander's intent, or mission order, and assignment of tasks to subordinates.[48] And finally, Schlieffen's essay of 1909 *War in Modern Times* stated "The way for infantry to advance in this environment was through a system of well coordinated fire support, using organic firepower as well as artillery, assigning tasks to subordinates…relying on their will and training to get the job done."

These indicators demonstrate that the Germans had the capability and tools in hand to develop these tactics when the necessity arose later on. The seeds were planted for the development of small unit maneuver tactics during the aftermath of the Boer and Russo-Japanese wars. German doctrine at the start of the war was developed to the point where the concepts of and ideas for modern tactics were in place. In practice, however, the German army still aimed at closing with the enemy in linear formations and eventually charging with the bayonet. Scherff

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[45] Echevarria II, *After Clausewitz*, 37
[46] Ibid, 38
[47] Ibid, 21

noted that "peace time instruction failed to meet the requirements of the modern battle." Their strict organization and reliance on Officers to directly control their units held back this crucial development for the time being leaving a huge gap between modern weapons capabilities and infantry tactics. "Although the German army's military doctrine had kept pace with the demands of modern warfare, the same was not necessarily true of its training procedures."[49] This doctrine was not translated into common practice until after 1914.[50]

The Germans were not the only ones that recognized the need for change. The Britons, French, and Russians all called for reforms in infantry tactics in response to difficulty in attacking infantry defending with rifled breechloaders. Dispersed formations, use of terrain, coordinated fire support all were common concepts recognized by the major militaries of the day. It must also be noted that these other armies' tactics, most notably the British and French, also failed to evolve or keep pace with modern weaponry despite the clear lessons learned during pre-World War I conflicts. The French were "…superstitiously faithful in the bayonet charge" which led severe casualties early on.[51] Even at the start of World War I the British, being set in their ways, continued to use strict linear formations and considered the machinegun as being irrelevant.

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[48] Echevarria II, *After Clausewitz,* 40
[49] Ibid, 127
[50] Ibid, 218
[51] Weller, *Weapons and Tactics,* 88

Closing the Gap Between Weapons and Tactics

"We had to adapt ourselves to an entirely new phase of war"

- Ernst Junger

During the course of the war there was a definitive chain of events that led to the rapid development of German infantry tactics. This chain started with the recognition of the effects of modern weapons on the battlefield and their effect on tactics, and ended with the use of stormtroop tactics throughout the German army by 1918. Both the Allies and the Germans started the war in 1914 using relatively the same tactics and modern weapons. By March 1918 the Germans tactical development far surpassed that of the Allies and resulted in major successes at the tactical level. The relationship that links modern weapons to tactics development will be covered in detail showing the initial tactics used, the stalemate that it created, the Germans development and experimentation, and the eventual solution. In addition, the reason that the Germans were able to develop tactics ahead of the other armies will be discussed along with the changes in command and control and organization structure.

Beginning of the War

The traditional tactics used by commanders at the start of the war were designed to deal with artillery that was only effective against infantry at close range and rifle fire from several ranks of infantry, accurate to 100 yards at rates of 3 rounds per minute. Infantry could expect to approach the enemy with acceptable casualties up to the last 100 to 200 yards and then assault in mass. Instead, what attacking infantry faced on the approach were high explosive artillery shells that were lethal to anything in the open for 5000 yards in front of the enemy lines. Then, once inside of 1500 yards they were engaged with machinegun fire at rates of 600 rounds per minute. Finally, at 500 yards the attackers were in range of infantry rifles firing at 10 to 15 rounds per

minute. On top of this, barbed wire, mortars, and hand grenades at closer ranges all made the approach to the enemy that much more deadly. Any thing that could be seen could be hit. The battlefield was drastically changed with the advent of these modern weapons making 19th century tactics obsolete."[52]

The German army lacked standardization and for the most part used traditional tactics from the start. Because of the inconsistent training that German units received prior to the war each unit acted differently. A prime example was the 43d Infantry Battalion on the Eastern front on September 9, 1914. This unit assaulted using open order formations, synchronizing fire and movement, and was supported by Regimental machineguns, resulting in casualty rates of only 2%.[53] During the same battle another commander in a nearby brigade ordered an attack in close order formation, resulting in 50% casualties of his brigade.[54] The traditional German doctrine of attacking the enemy flank or envelopment was impossible because there were no flanks in the extended lines of defense that developed during the early stages of the war.

The Great Stalemate

> Allies inflicted massive German casualties due to the range, power, and speed of fire of their new weapons… turning the western front into static attrition warfare" and put an "…end to maneuver in the old sense… there were no flanks.[55]

Both sides paid dearly for ignoring the lessons of the Boer War and Russo-Japanese War. The onset of positional warfare, and the resultant attrition of a large portion of the Germans fighting force, raised tactics development to a far greater importance.[56] As a result of the massive defensive firepower that discouraged attackers, trenches were built up faster than artillery could

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[52] Weller, *Weapons and Tactics,* 88
[53] Echevarria II, *After Clausewitz,* 214
[54] Ibid
[55] *Weller, Weapons and Tactics,* 87

destroy them.[57] To dispel flanking movements by the attacker trench lines were connected and resulted in a continuous front line from Switzerland to the sea. The German reaction, the first step to eventual changes in offensive tactics, was to first change defensive tactics.

Defensive tactics began to evolve around the theory of a defense-in-depth with a formidable counter attack. This defense in depth allowed the front line to absorb an attack and then destroy the attacking force with the counterattack. The counter attack force required smaller units to be self reliant in determining the time and place for the counter stroke, which in turn relied upon decentralized control and more capable small unit leaders. "Fortunately for them, the Germans had an abundant supply of first-class peacetime-trained noncommissioned officers. The group of one NCO and eleven men now became the official tactical battle unit. To educate the German army in this system, a booklet entitled "The Defensive Battle", written by Colonel Max Bauer and Captain Herman Geyer, was issued to all German divisions in December 1916."[58]

For offensive attacks, by early 1915, the Germans, out of necessity, had reverted to what they called "Boer" tactics. These forms of assault began to use mines, saps, light howitzers, and trench mortars to facilitate attacks on strong allied trenches. By supporting attacking infantry with firepower it gave them a means of crossing "no man's land" without suffering the number of casualties at battles such as Ypres. The final assault, however, still ended in charging the trenches with bayonets. [59] The Germans also used the cover of night and early dawn to provide concealment from machine guns and artillery spotters. [60] These newly evolving tactics were

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[56] Gudmundsson, *Storm Troop Tactics*, 13
[57] *Weller, Weapons and Tactics*, 89
[58] English, *On Infantry, 15*
[59] Gudmundsson, *Storm Troop Tactics*, 43
[60] *Weller, Weapons and Tactics*, 88

usually referred to as "attacking with limited objectives" and were focused on gaining a specific piece of terrain without exploiting further.[61]

Identifying the Problem

> How will we manage to execute tactical offensives in the lead-filled atmosphere of the new weapon?
> - Unknown[62]

The problem put to the Germans was how to cross no-mans-land without prohibitive casualties, approach the enemy lines undetected if possible, take the trenches, and then hold the conquered ground. The only means available at first were normal infantry units, maneuvered by individual regiments, while shelling the enemy lines with long-range artillery. But artillery fire only telegraphed the attackers intentions to the well-protected enemy and caused little affect on the trenches. Changes were clearly needed in tactics if the Germans were to make any progress in their operational and strategic objectives that required advances on the French and British and defeat of their armies.

The Allies resorted to mass fires and gradual attrition using heavy artillery bombardments and fortified machinegun emplacements. They were able to do this primarily because they had the luxury of a wealth of material support. Germans did not posses the capability to match the wartime production of the Allies due to an inferior economy and the British Naval blockade.[63] This forced the Germans, by necessity, to change from reliance on material to more qualitative means".[64] As an evolving solution, "the Germans soon began turning the decentralized tactics of

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[61] Gudmundsson, *Storm Troop Tactics*, 43
[62] *Brose*, The Kaiser's Army, 71
[63] Samual, *Doctrine and Dogma*, 13
[64] *Ibid, 13*

the elastic defense into new tactics for the advance. Methods used in the counter attack were accordingly applied to offensive operations." [65]

The Tactical Solution

"The experiences of 1914 caused the so-called traditional understanding of tactics, built over decades of peacetime training, to be discarded."[66] The question became "how to deal with the defenders' fire."[67] There are many theories on the origin of the rapid development of German infantry tactics during World War One. It is often times explained as a product of individual genius, usually crediting General Oskar von Hutier, a cousin of Erich Ludendorff, who happened to be the commander of the German Eighteenth Army during the successful offensive of March 1918. The Allies were quick to explain away their defeats to Hutiers genius at his invention of Stormtroopers, labeling them "Hutier tactics" and reasoning that they were practiced by only a core of specialized Stosstruppen units.[68] Others credit the new tactics origin with Frenchman Andre Laffargue, copies of whose pamphlet on tactics, similar to the early German tactics, had been captured by the Germans in 1916/1917.[69] In fact, the first use of Storm Troop tactics were seen as early as 1914 and were eventually used by the majority of the German army and was not isolated to special units.[70] In addition, these tactics actually originated from doctrine that was formulated before the war started.

In contrast to some of the above ideas, German infantry tactics actually evolved out of necessity in response to the modern weapons used in the large-scale environment of the western front. Many units across the German western front began developing specialized assault units

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[65] English, *On Infantry*, 18
[66] Samual, *Doctrine and Dogma*, 34
[67] Ibid, 13
[68] Samual, *Doctrine and Dogma*, 3
[69] Gudmundsson, *Storm Troop Tactics*, xiv

on their own, simultaneously. One of the junior leaders that proved to be very successful was First Lieutenant Erwin Rommel of the 124th Infantry Regiment. Another example was Major von Hadeln and Captain Willy Martin Rohr, of the Guard Rifle Battalion. These units, lead by these forward thinking individuals, proved to be very successful as early as December 1914. One of the more successful, and improvised, tactics they used at the Vosges was to sneak up on the enemy flank in the trenches, and "roll up" the trench using hand grenades.[71] Most of these tactics depended on close coordination with supporting fires, organic fire support, and the use of decentralized control of small units. Limited objectives did not, however, support exploitation and the ability for artillery support beyond the objective. This was demonstrated in the attack of Vregny Plateau, near Soissons, in January 1915. Although an initial success, it was clear to the German army that their infantry tactics were in need of modification.[72] On the other side, the Allies failed to recognize these tactical lessons and instead emphasized artillery in place of, not supporting of, infantry maneuver and fire.[73]

Experimentation

The Germans were very proactive in development of tactics early in the war. In March 1915, the German War Ministry, with the help of Lieutenant Colonel Max Bauer formed an Assault Detachment from the Eighth Army Corps with the express purpose of experimenting and developing tactics. The initial thought was to incorporate the 37mm lightweight field gun, "Storm cannon" designed to create a large enough gap in the enemy trenches for normal infantry to exploit and continue to maneuver.[74] The first organization failed to create an effective assault

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[70] Samual, *Doctrine and Dogma*, 3
[71] Gudmundsson, *Storm Troop Tactics*, 34
[72] Ibid, 32
[73] Ibid, 23
[74] Ibid, 46

force, partly due to it being formed from Pioneer personnel. Bauer soon replaced the first commanding officer with an aggressive Captain named Willy Rohr, who had a light infantry background and was a proponent of heavy firepower.[75] Bauer gave him free rein to train and experiment along with a variety of weapons units including machinegun, flame tower, and trench mortar platoons. The direct fire Russian 7.62 cm gun, modified to be more mobile, soon replaced the 37mm gun. This gun was better suited for taking on machine gun nests, was more responsive to infantry, and posed less risk to friendly infantry from inaccurate fire.[76] Another part of the initial experiments was with personal armor, but the only piece that remained was the trademark German style M1916 Stahlhelm steel helmet.

Rohr's experimentation led to three essential elements: (1) the replacement of the advance skirmishers with squad sized surprise assault units called Sturmtruppen (Storm units), (2) the integration with supporting arms (machine guns, infantry rifles, flamethrowers, indirect artillery, trench mortars) coordinated at the lowest level, and (3) the technique of rolling-up trenches with hand grenades and flamethrowers.[77] This was a functional approach to the tactical problem, supplementing heavy artillery with organic mortars and shifting from a linear approach to small groups of machine gunners, grenadiers, and flamethrowers. Also, this approach began to concentrate on the effects it had on the enemy instead of the enemy forces themselves.

This was a radical departure from the tactics being practiced by most of the German army in the field in 1914. However, these techniques were relatively close to the doctrinal concepts that the Germans formulated prior to the war. These new tactics were focused on a specific objective, and labeled as "attacks of limited objectives". Squads were used as tactical entities

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[75] Samual, *Doctrine and Dogma*, 15
[76] Gudmundsson, *Storm Troop Tactics*, 48
[77] Ibid, 49

that maneuvered on their own using no predetermined formation or connections in any way where "the objective guaranteed unity of action".[78] In a way, these new tactics can be looked at as miniaturization of the old tactics. Instead of maneuvering whole armies to envelope the enemy it was done on a much smaller scale where individual units maneuvered themselves to envelope smaller portions of the enemy.

This ultimately changed the role of the NCO and junior officer from being behind the squad, urging them on, to leading from the front. It also required that each man be aware of the objective and have a detailed knowledge of the specific mission where "…the squad had become an irreplaceable element in an overall plan…".[79] The chief role of artillery and other supporting arms became one of suppressing the enemy to allow the infantry to maneuver and stressed the need for fire superiority before attack[80]

Changes in Artillery Tactics

Georg Bruchmuller was greatly responsible for establishing techniques on delivering fast and accurate neutralization fire in 1918. His techniques used a concentration of fire for a major attack in depth with an accurate creeping barrage that proved to be instrumental in supporting these tactics. His techniques required strict control of artillery batteries and subjected them to a support role for infantry. These tactics also allowed for the element of surprise during attacks, unlike the Allies who used hours of artillery barrages prior to the main attack.[81]

[78] Ibid, 50
[79] Gudmundsson, *Storm Troop Tactics*, 51
[80] Echevarria II, *After Clausewitz*, 72
[81] More on Bruchmullers contributions on integration of artillery with infantry is covered in the *Other Considerations* section.

Operational Testing

The Assault Detachment successfully tested these tactics in actual combat in several places. The first test was in company strength in October 1915 on a French position in the Vosges Mountains, known as Schratzmannle.[82] Again at Hartmannsweilerkopf in January 1916, while leading two regular infantry regiments, the Assault Detachment was used as a complete unit. Both operations were very successful and resulted in very few casualties and followed the same general guidelines of a detailed rehearsal, individual squad movement, and close coordination of supporting arms. Conversely, at Verdun, February 1916, the Assault Detachment was piecemealed out to separate infantry battalions with mixed results. Many of the Battalion Commanders were not familiar with the Stormtroop tactics and used them as regular infantry. Other commanders successfully used these company or squad sized units to lead assaults against French strong points with some success. The actions at Verdun also proved to be the first place that Assault Detachment "Rohr" tactics were used by regular infantry.

The battle of Verdun also demonstrated the capabilities and limitations of artillery in that it was best used to suppress the enemy to allow Stormtroops and infantry to maneuver. Rolling waves of artillery progressed according to a predetermined time schedule from in front of enemy lines to beyond. This in turn led to the need for better communication between forward observers and artillery batteries to adjust this timing to coordinate with the advancing infantry. Another lesson learned at Verdun was the technique of bypassing strong points and enveloping them, which evolved naturally out the decentralized organization of the assault units. This soon led to the requirement that the strong points be known ahead of time for planning and rehearsal. If intelligence was lacking skirmisher lines were used as a reconnaissance in force to find the

gaps and surfaces of the enemy.[83] Once found, the commander was able to direct Assault Detachment units against them, further refining the use of the specialized units. The measure of success became the battle at Ypres in 1914 in regard to numbers of casualties that were acceptable in crossing no-mans-land during an attack.[84] Once the first trench line was taken the follow on defenses still remained a problem, being out of communication with their own artillery and trench mortars. Flame-throwers, heavy machinegun, and trench mortar detachments solved part of the problem by providing attacking infantry with their own supporting arms.[85]

Soon after Verdun the Detachment was expanded to an Assault Battalion "Rohr" and four Jagur battalions were converted to Assault Battalions. The success of these units was quickly being recognized throughout the German Army. General Eric Ludendorff, visiting from the eastern front, took notice of these elite units in the fall of 1916 and was immediately determined to make them the model of the entire German Army.[86] He soon signed an order to form a battalion within each army on the western front, for a total of 15 assault battalions, each designed after the original "Rohr" Assault Battalion. Ludendroff's order read:

> "Each battalion consisted of two to four assault companies supported by one or two machinegun companies, a light trench mortar company, an infantry gun battery, and a flamethrower platoon. Tactics and techniques were carried out according to the Instruction for Employment of an Assault Battalion, written by Captain Rohrs. This manual detailed the tactics of assault squads under the command of an NCO. The squads task was to lead an infantry platoon and company through no mans land, through enemy wire, break into the enemy trench system, roll it up with hand grenades, and destroy enemy bunkers and machine gun nests. Supporting arms were to be used to facilitate movement of attackers across no mans land. Organic infantry guns were used against known machine guns and field pieces while machine guns covered the flanks and suppressed enemy machine guns. Trench mortars, grenade launchers and supporting artillery suppressed enemy riflemen on the front line, isolated the objective, and suppressed enemy guns. Flamethrowers were the only

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[82] Gudmundsson, *Storm Troop Tactics*, 49
[83] Ibid
[84] Gudmundsson, *Storm Troop Tactics*, 46
[85] Ibid
[86] Ibid, 84

> supporting arms to move with the assault units and were used to clear trenches. Assault on the trenches was timed with the last shell of the artillery barrage and the following infantry took position of the secured trench and defended against counterattack. These basics were incorporated into the German training manuals as early as 1916 and soon being taught to new recruits, a mere two years after the start of the war."[87]

The Final Product.

German tactics development resulted in a high degree of decentralization of control and instead of attacking "limited objective" in waves, the advancing infantry flowed in small groups along lines of least resistance, seeking out "soft spots" through which to penetrate enemy defenses.[88] Attacking in depth, a fluid maneuver concept, combined arms support, retaining initiative, and a balanced mix of weapons including riflemen, machinegun, and light field artillery were all important concepts. Surprise was attained by using shorter artillery barrages in preparation and artillery was directed at enemy communications and artillery. Storm troop battalions spearheaded the assault, bypassing strongpoint and infiltrating small groups. Initial waves were followed up first by stormtroop companies with flamethrowers and other mop up capabilities, and then by heavy but mobile weapons to secure flanks and provide fire support in the attack. Multiple layers of reserves reinforced success and defeated counter attacks, maintaining the momentum of the attack. Like the remainder of the German infantry, the basic tactical unit was a group of 10 to 12 men with its own fire support provided by a light machinegun and light mortar.[89] Summed up in Ludendorff's words, "… the smallest molecule of the German infantry arm contained within it the essential requirements for both defense, the parry by the light machinegun *Trupp*, and for the offense, the thrust of the *Stosstrupp*."[90]

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[87] Gudmundsson, *Storm Troop Tactics*, 85
[88] English, *On Infantry*, 19
[89] Ibid, 20
[90] Gudmundsson, *Storm Troop Tactics*, 41

Other Considerations

Standardization

Although being elite in nature, the Assault Battalions tactics began to spread throughout the German army through dedicated training. The secondary duty of the Assault Battalion was to train Officers, NCOs and whole units throughout the army. This was also the major difference between the Germans and other countries in their use of specialized assault units in that the French and British kept their trench raiding units isolated and did not attempt to train the rest of their forces.

The integration of specialized units with the infantry proved to be essential. The individual assault and machine gun units provided the platoon and company commanders with two new variations to base their tactics on. Suppressive fire from the machinegun squad allowed the infantry and assault squads to maneuver to a position to the flank or rear of an objective and attack it with rifle fire or grenades.[91] In addition, machinegun squads often worked as independent units on their own, using their organic backup gunners as maneuvering infantry while being covered by the machine gun to assault the objective. This provided self contained fire and maneuver elements within the same small unit and could work autonomously towards an overall objective. By the end of 1917 "…every infantry unit down to the platoon was a combined arms force, capable of supporting its maneuver with its own fire." [92] The control of these units was in turn decentralized, relegated down to the Lieutenant and NCO level.

[91] Gudmundsson, *Storm Troop Tactics*, 100
[92] Ibid, 101

The Defense

Similar to offensive tactics development, defensive tactics rapidly developed during the early periods of World War One as well and actually provided the basis for offensive tactics. The first progression of this development was adding depth and flexibility to the defensive line. After the massive expense of holding terrain at all costs was realized, the Germans developed timely counter attacks to destroy the attackers. The German army formalized and distributed this defensive doctrine through *Principles of Command in the Defensive Battle in Position*, written in December 1916 and updated in March 1917.

> "The aggressive tenor of the elastic defense-in-depth, especially the counterattack, nurtured offensive excellence.[93] Much like Stormtroop units, NCOs often working autonomously individually led these small counterattack units. These defensive measures grew over time and resulted in highly elaborate trenches based on elastic defenses-in-depth and provided a "…solid base of doctrine and experience for offensive operations."[94]

The changes provided a clear lead-in to offensive tactics. In fact, the offensive tactics can be looked at as attack-in-depth, similar in concept to the defensive tactics. Similarities include the use of terrain for cover and concealment, mission objective focused on the enemy and not position, depth and flexibility with use of combined arms, and independent attacks using squad to company sized elements. In addition, both the defense and the offense tactics required a streamlined chain of command, as well as leaders and their initiative. This command and control philosophy was required because the character of these tactics "forbade wasting time by waiting for permission from higher headquarters". [95]

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[93] Lupfer, *The Dynamics of Doctrine*, 38
[94] Ibid, 38
[95] Ibid, 20

Doctrine and Organization Changes

The operations section of the German General Staff "… did not invent tactical concepts".[96] More accurately, it solicited ideas and opinions from units in the field, examined as much empirical data as possible, defined and developed tactical principles, and articulated these final decisions for distribution to the army. Ludendorff was one of the most influential proponents to adopt new tactics. He demanded accurate feedback from subordinates and combat units, was flexible, and unlike most Generals of his time, he was willing to change. His willingness to change tactics was surprising due to his experiences in the east under entirely different conditions than the west, and the fact that Germany was in the midst of an all out war. "Here (in the west) we met with new conditions and it was my duty to adopt myself to them.[97] Also, during the winter of 1917-18, the Army High Command developed a new offensive tactical doctrine in hopes of achieving a decisive victory on the western front."[98] This was a significant achievement considering being in the middle of a desperate war. "These tactical changes were systematic and thorough, for these changes in doctrine directly affected subsequent battlefield success."[99]

The German army organization changed drastically over the short span of a few years due to the adaptation of stormtroop tactics at General Ludendorff's insistence. One example of the organizational change was the ratio of infantry companies to machine gun companies increased from 1:12 to almost 1:2, and was placed directly under the control of the battalion commander. Similarly, the number of trench mortar units was increased four fold. Increased mobility was also a priority as can be seen by the introduction of a light tripod for the Maxim machinegun and

[96] Lupfer, The Dynamics of Doctrine, 10
[97] Ibid, 9
[98] Ibid, vii

a wheeled carriage for the light trench mortar.[100] Organic artillery to the Division was decreased and the number of large supporting artillery batteries grew in proportion. Appendix B shows the changes in organization from 1914 to 1918 (figures B1 and B2) as well as a typical Assault Battalion in 1918 as shown on table B3. It can be seen that at the battalion level things changed drastically from having just three infantry companies to the addition of a machine gun company, grenade launcher platoon, and a mortar platoon. These changes were in addition to having special Assault Battalions in support of the division.

The changes in tactics and doctrine were made official with the publication of *The Attack in Position Warfare* in 1 January 1918. In contrast to the doctrine changes that occurred before the war, Ludendorff and the General staff strictly enforced the training and corps commander's use of these tactics. This fact solidified the transformation from traditional close order tactics to the revolutionary infantry tactics of 1918. Tactics on paper were one thing but proper execution was proof in the pudding. Germany was able to train the majority of the army over a few short years during wartime on a completely revolutionary change in doctrine.

Decentralized Control

"The evolution of tactical fighting units on the battlefield was affected as much by control considerations as by developments in weapons technology. Open order tactics tended to be disorderly and inherently prone to desertion."[101] The transformation of the skirmish line as the principal combat formation, to open order formations created new challenges for commanders.[102]

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[99] Ibid, viii
[100] Gudmundsson, *Storm Troop Tactics*, 97
[101] English, *On Infantry,* 3
[102] English, *On Infantry*, 4

The increased dispersion made it impossible for one voice, or commander, to control the detailed movements of a battalion, or stay informed of the subordinate units status and position.

Throughout the course of this transformation in the offensive, German platoon commanders were semi-autonomous, with smaller, isolated units, which led to a "family like" unity with the NCOs.[103] This integrity instilled unity within the units as well as a sense of independence. Also, the cultivation of their NCOs was an important step in reaching a decentralized organization that would allow the use of dispersed tactics. This independence was fostered by the German army which included giving commanders flexibility in training and the ability to experiment with new tactics. It also forced and encouraged subordinate leaders to be more self-reliant and to think independently.

Another reason why decentralization worked with the Germans is that Army Corps soldiers were recruited from within individual districts in Germany, giving them a form of unity. The commander of each district was free to train its troops any way they wanted and usually passed this autonomy down to the company level.[104] This provided them with the flexibility to rapidly react to unplanned situations. This decentralization also forced a dependence upon the average soldier to be better educated, self-reliant and have a sense of honor. Overall, experimentation with open order tactics, decentralization, and the groundwork for the development of tactics, allowed the infantry to evolve in reaction to the new threat of modern weapons and forced the commander to concentrate the infantry on a decisive action to affect the enemy. The initial response of dispersing formations to counter modern weapons forced the German army to

[103] Weller, *Weapons and Tactics*, 93
[104] Gudmundsson, *Storm Troop Tactics*, 19

decentralize control of subordinate units. This in turn cultivated the use of mission type orders and fostered initiative in small unit leaders

Training and Standardization

By 1918 "each German field Army had a storm battalion that acted as a teaching cadre during periods of training."[105] Training was accomplished during lulls in the fighting, usually during the winter months and took place just behind the front lines. The training of advanced tactics was held in such high regard by the leadership that Officers and NCOs from the eastern front were sent to the west to train as early as 1916. This wide spread training introduced standardization in the German army that they had not had before. The Doctrine behind the new tactics had been in place for the past decade without it being formalized, widely accepted, or trained to. By standardizing the new tactics, and ensuring their use throughout the army, the Germans completed the transformation to these "revolutionary' tactics.

Combined Arms

One of the more critical concepts that enabled the German army to revolutionize infantry tactics was the advent of combined arms concepts, which can be attributed primarily to Colonel Georg Bruchmuller. These tactics evolved in a similar way to infantry tactics throughout the early stages of World War I resulting with the synchronization of fire support with the overall scheme of maneuver.[106] Through the use of a wide variety of direct and indirect weapons, changes in techniques, and a system of forward observers (essential for the newer long range weapons), artillery fires were successfully integrated into the infantry's actions.[107]

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[105] Lupfer, *The Dynamics of Doctrine*, 43
[106] David T. Zabecki, *Steel Wind*, (Weat Port, CT, Praeger, 1994) 43
[107] Ibid

A few changes in how artillery was employed proved instrumental in the attack. The first was regaining the element of surprise. At first, artillery preparations for and attack included long periods (days) of preparation fires and initial registering of the guns.[108] Bruchmuller developed a procedure for registering the guns during the initial preparation fires, that were themselves shorted (3 to 5 hours), and concentrated on specific objectives instead of just the enemy front lines.[109] One other change in tactics for artillery was a shift from the need to destroy the objective to neutralizing it in support of infantry maneuver.[110] The first use of coordinated fires on a large scale at Riga in September of 1917 an proved very successful.

A system of forward observers was set up which provided artillery-spotting teams down to the regimental level, some of whom accompanied the front line troops. Communication was accomplished by telephone between the artillery batteries, Fire Support Officers, and front line forward observers. In addition to forward observers, Bruchmuller initiated briefings on the fire support plan during the planning stages of the attack. These briefings included artillery organization, locations of firing units, duration and timing of preparation fires, rate of advance of the creeping barrage, and were given to platoon leaders to include NCOs.[111] These main concepts of combined arms that Bruchmuller initiated are ones that are taken for granted today but were revolutionary at the time, and proved to be a major factor in the success of German Army tactics by 1918.

Allies vs. German solutions

"Artillery conquers, infantry occupies"

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[108] Zabecki, *Steel Wind*, 12
[109] Ibid, 15
[110] Ibid, 17
[111] Ibid, 46

- Marshal Henry Philippe Petain

The German army in the early 1900s was more able to adapt these new tactics than were the Allies due to the British and French reliance on the brute force of heavy artillery, the strength of the defense, and their use of centralized control that stifled initiative and responsibility. Even though the Allies were exposed to the same lessons of earlier conflicts that the Germans were, the Allies changes in doctrine were studied, theorized, and written about but never implemented. The British mindset was very restrictive to change at the tactical level and their attitude was to follow the prescribed doctrine to the letter. The British army was also used centralized control that did not allow commanders at lower levels, specifically below regimental, to become self-reliant. One factor that accentuated this trait was that at the start of the war many of the experienced British commanders were used on staff while inexperienced commanders were sent to the line. This prevented the officers with more experience, and who may have recognized the need for decentralization and changes in tactics, from developing tactics.

Despite this, small units that performed similarly to the German Assault units did emerged within the British and the French armies during the war at a small level. These units were used as trench raiding parties and not prevalent throughout the army. They were used more as specialized units and not for training the rest of the army, as were the German Assault Battalions. The British tended to regard such fire-and-movement as too difficult to teach, and continued to attack in waves under creeping artillery barrages through the end of the war.[112]

The British also possessed few machine guns at first and relied on separate machine gun units, which were not attached to infantry, and used for general defensive support.[113] Both the British and the French used light field guns at first that were very mobile but soon built up a

reliance on long range heavy artillery. The reliance on artillery, as well as long range machinegun and rifle fire, were used to hold off enemy attacks and against enemy forward lines This caused each side to simply dig deeper and quickly led to a stalemate and well known trench warfare.

In general, the Allies relied heavily on massed firepower of modern weapons, pursuing a "…technical solution to the tactical problem".[114] This resulted in a massive buildup of heavy artillery pieces and long-term barrages in preparation for assaults. In keeping with the thought of necessity, the Allies resorted to mass fires and gradual attrition against machinegun emplacements primarily because they had the luxury of material support. In contrast to the allies, "attack-minded Prussian General Staff" continually stressed the offense despite the demonstrations of the superiority in defense.[115] With this offensive mindset, and the limitations in men and material, the Germans were more prone to exploring a tactical solution to the technical problem, rather than rest on the strength of the defense.

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[112] English, *On Infantry*, 14
[113] Ibid, 88
[114] Lupfer, *The Dynamics of Doctrine*, 39
[115] *Brose, The Kaiser's Army*, 87

Summary

On 21 March 1918, the Germans launched a desperate offensive into France called Operation MICHAEL. In five days, they had recaptured all the land they had lost around the Somme in the previous two years. "It was clear that the Germans had found a solution to the problem of attack in position warfare…".[116] German doctrine had achieved the balance between the demands of precision for unity of effort and the demands of flexibility for decentralize application.[117]

World War I was the first time that modern weapons were used on a large scale for an extended period of time. The offensive tactics used initially by the Germans and Allies (close order, linear formations, little coordination with fire support, and centralized control) were ineffective against these weapons and resulted in massive casualties on both sides. The Germans recognized this early on, partly out of strategic necessity from being limited in men and material, thus bringing about the search for a tactical solution for a technical problem. The Germans solution was to concentrate on the development of tactics to counter the effects of modern weapons. These tactics were initially developed before World War I as a result of lessons learned from the Boer Wars and other conflicts that demonstrated the deadly effects of modern weapons against traditional tactics. The development of these tactics eventually resulted in Assault Battalions, or Stormtroop tactics, and their proliferation throughout the German Army.

The development of tactics and changes in doctrine before the war, however, did not produce a transformation in the German army. Only after re-learning the lessons from before the war, developing and testing new concepts, and then training the majority of the army did the Germans put into practice these revolutionary tactics.

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[116] *Samual, Doctrine and Dogma*, 1
[117] Lupfer, *The Dynamics of Doctrine*, 55

The essence of Stormtroop tactics was the intangibles, such as the command relationship between officers and NCOs and men, the relatively decentralized organization of the German Army, and the coordination of fires with infantry maneuver.[118] The German Army was predisposed for developing tactics due to the freedom that decentralization gave the junior Officers and NCOs, allowing them to train and fight as they saw fit. These factors led to a control philosophy that allowed subordinate units to maneuver as appropriate to fit the situation with the guidance of mission type orders. As Clausewitz stated "nor can the theory of war apply the concept of law to action, since no prescriptive formulation universal enough to deserve the name law can be applied to the constant change and diversity of the phenomena of war." The relationship between weapons and tactics also relates well with Clausewitz' discussion of war being both an art and a science in that it "depending upon creative ability", the art, and in the physical capabilities of weapons, the science.[119] This demonstrates a direct link between technology, tactics development, and command and control and may provide relevance to modern technology and tactics development relationships.

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[118] Gudmundsson, *Storm Troop Tactics*, 19
[119] Carl von Clausewitz, *On War*, Edited and translated by Michael Howard and Peter Paret, (Princeton, NJ, Princeton Press, 1976) 148

Conclusions

From the mid 1800s to 1918 the German army proactively recognized, identified, and developed and implemented solutions to the evolving problem of infantry attacks against modern weapons. By following these four basic logical steps it can be clearly seen that the modern weapons used during World War I instigated the development and implementation of the revolutionary tactics that the German army used during the spring offensive of 1918. These new tactics were clearly revolutionary due to the advantage they presented at the tactical level, their link to modern tactics, and their impact on follow on advances in tactics such as Blitzkrieg in World War II.

German Ability to Adapt

The ability and freedom that commanders had to adapt to changing situations and implement tactics as they saw fit played a crucial role in their success in formulating and implementing new tactics. The fact that many units, independent of each other, were developing similar tactics at the same time all along the western front indicates that this evolution in tactics was a natural progression in response to a common factor. The common factor across the western front that drove this development was the proliferation of modern weapons. Also, the Germans evolving decentralized organization and commanders freedom in training allowed them to experiment and react to evolving situations on the battlefield. The fact that these changes were standardized so quickly throughout the army, to include doctrine in writing and recruit training, shows that the leadership involved was extremely insightful to recognize the importance.

Weapons Versus Tactics

"The events of World War I abruptly focused attention upon the relative significance of material in securing victory."[120] The fact that superior weapons favor victory was a shift from the reliance upon manpower in the way military leaders thought. The use of new technology in one aspect of warfare, and the subsequent change in doctrine, sets up a chain reaction and the need to adapt in other aspects of war. Italian General Douhet once said, "the form of war…depends upon the technical means of war available". The technical means of war in World War I was the improved infantry rifle, machinegun, and artillery. The tactics to deal with these technical means was immature at the start of the war. In response to this the German army improved tactics at a very rapid rate to counter the advantages of the increase in firepower.

The Germans placed a higher priority on tactics development than technology and chose not to develop larger weapons due to material shortages and in the interest of time. The British, on the other hand, placed priority on technology, such as heavy artillery and the tank, and did not fully develop tactics to support technology. By the end of the war tactics had overtaken technology, which demanded improvements in mobility and protection, eventually resulting in improved tanks, airpower, rockets, etc. This created a leap frog affect of technology and tactics, whereas technology started out in front of tactics at the beginning of World War I, and then tactics overcame technology, and so forth.

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[120] I. B. Holley, Jr.,*Ideas and Weapons: Exploitation of the Aerial Weapon by the United States During World War I; A Study in the Relationship of Technology Advance, Military Doctrine, and the Development of Weapons,* (Office of Air Force History, Washington D. C., 1983), 12

Revolution in Military Affairs

According to Andrew Marshall, director of the Office of Net Assessments in the Office of the Secretary of Defense, "a Revolution in Military Affairs is a major change in the nature of warfare brought about by the innovative application of new technologies which, combined with dramatic changes in military doctrine and operational and organizational concepts fundamentally alters the character and conduct of military operations." "For example, chemistry and early physics drove many of the advances critical during World War I, …" and "…. the rate at which weapons fired and the ranges that the projectiles traveled decided the fate of many battles."[121]

> "The longbow gave the English at Crecy in 1346 a crucial advantage over the French forces. Yet the bow was not a novel technical breakthrough: its successes in the past had been largely ignored. Indeed it is surprising how often weapons that alter the whole conduct of land warfare are not the technological novelties, but the thoughtful application of well understood techniques. In a similar way, infantry tactics used towards the end of World War I were evolving well before the war started. The Germans brought these tactics to the forefront during World War I out of a necessity to counter modern weapons."[122]

The tactical revolution during World War I, which saw development of accurate indirect artillery fire with decentralized infantry tactics that relied on fire, maneuver, and exploitation, emerged from the slaughter on the Western Front in 1918 after three long years of learning.[123] This RMA was the result of a series of Military Technical Revolutions (MTR) involving the machinegun, infantry rifle, and artillery. These MTRs were a direct result of the industrial revolution and the "Machine Age". Technology, even when developed into a revolutionary weapon or system, is not enough to produce an RMA. "It must be combined with doctrine (i.e.,

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[121] Jeffrey McKitrick, James Blackwell, *The Revolution in Military Affairs*, (Strategic Assessment Center. McLean VA: Science Applications International Corporation, December 1995)

[122] Tim Garden, *The Technology Trap: Science and the Military*, Draft Update of 1989 Brassey's publication. (Posted on author's website, July 1998, http://www.teagarden.demon.co.uk/writings/techtrap/ttdraft.html), chapter 3, Land Warfare

an agreed-upon concept for the employment of the new weapon or system) and organization (i.e., a military force structure crafted to exploit the new weapon or system)."[124] "RMAs often take a long time to come to fruition. Although all of the major technology developments embodied in the machine gun were essentially completed by the 1870s, it did not come to fruition as an RMA in European warfare until September 1914, some 40 years later."[125] Similarly, modern artillery was relatively developed by the 1890s but not fully utilized, nor doctrine developed for, until well into World War I.

Germany, and the Allies, possessed the revolutionary modern weapons and, arguably, the new doctrine, well before World War I started, but it was not fully accepted by, or trained to. The revolutionary doctrine was put into practice only after Ludendorff and others insisted on thorough training and implementation throughout the army.

Modern Examples

The use of Special Forces in Afghanistan in the War on Terror is a good example of where the same RMA of tactics may be progressing. Similar to the transition from close order and centralized control to open order and decentralized tactics during World War I, these tactics are even more decentralized in nature. They rely even more upon smaller, more dispersed units, independent action, coordination with organic and external fire support (such as B-52s), and specialized training. In the same vein, the Special Forces are given mission orders that leave greater room for interpretation but are coordinated with other small units working for an overall

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[123] Williamson Murray, *Thinking About Revolutions in Military Affairs*, (Joint Force Quarterly (Summer 1998), 73

[124] Murray, *Thinking About Revolutions in Military Affairs*

[125] Murray, *Thinking About Revolutions in Military Affairs*

objective. This can be looked at as a continuation of the trend that was started by the Germans in World War I, or perhaps the next RMA in ground combat.

One of the newest technology advancements that can be considered an MTR is the advancement of information systems and their impact on command and control. The capabilities of computers and communication systems on the battlefield today are have major implications in the flow of information in both directions, up and down, leading to more decentralized control. Accurate, real-time intelligence of the battlefield is now available to small units in the field, to include platoon commanders and aircrew. These components are being given the situational awareness of both friendly and enemy situations by a variety of collection and dissemination systems. This capability will lead to a more decentralization of control because the operator, company commander or aircrew, has the ability to acquire the information required to make independent, strategic level decisions, and also has the firepower and tactical capability to act. The war fighters on today's battlefield are also better educated, better trained, and have far more firepower at their fingertips than in the recent past. This results in the ability of a single individual to cause greater affects on the battlefield over a shorter time period, thus decreasing the decision cycle time (shrinking the OODA loop) or sensor to shooter time.[126] This increased information flow should be fostered, and not used for micro-managing, just as the Germans fostered the leadership abilities of their junior officers and NCOs in World War I. .

In closing, the following points summarize the issue of modern weapons effects on German infantry tactics in World War I. The military conflicts during the period prior to World War I displayed the effects of modern weapons against traditional tactics. They also demonstrated the

[126] The OODA loop cycle is a decision cycle concept developed by USAF Major Boyd consisting of Observe, Orient, Decide, and Act. My own variation on this concept is the BOBA loop decision cycle - Bash, Observe, Bash Again.

natural changes in tactics that took place in response to these modern weapons. The German army studied these conflicts intently and drew numerous lessons learned form them. In turn, they established doctrine, to include revisions of their service regulations that were revolutionary in comparison to traditional tactics and other major militaries. These lessons learned and advanced tactical doctrine set the conditions for revolutionary tactical development. However, the importance of this doctrine was not realized until the start of the war in 1914 where traditional tactics proved devastating to infantry and wasted great numbers of men and material. Despite the early developments of doctrine the tactics were not fully developed until during the later portions of the war and then fully implemented, a little too late, by Operation MICHAEL in 1918.

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